

PE - 2

**THE DEVELOPING AN ASSESSMENT INSTRUMENT BASED ON BOARD
GAMES TO MEASURE PHYSICS LEARNING ACHIEVEMENT OF SENIOR
HIGH SCHOOL STUDENTS**

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Abstract

This research aims to develop an instrument based on board games for measuring senior high school students' physics learning achievement (PhysIBoGame) and to obtain the characteristics of the PhysIBoGame. The instrument blue print has been developed based on the aspects and subaspect of cognitive domain, then it was used to develop the items. The PhysIBoGame consisting of 60 items were validated by physics educational measurement experts, physics educational experts, and practitioners. The validated instrument was tried out to 401 students of senior high schools in DIY. The polytomous data were analyzed according to the partial credit model (PCM). The results show that the 60 items of the PhysIBoGame were fit to the PCM and the PhysIBoGame was reliable. Therefore, the PhysIBoGame is qualified for the measurement of senior high school students' physics learning achievement.

Key words: Instrument development, board games, physics learning achievement, polytomous, and PCM

INTRODUCTION

Assessment defined as a process for obtaining information that is used for making decision about students; curricula, programs, and school; and educational policy (Nitko & Brookhart, 2011:3). Mardapi (2013:2) states that assessment is an activity of data calculation. So, assessment is a process of collecting student's information by calculating their learning achievement and then the data calculation will be concluded using a criteria to make diccision.

Assessment of physics learning achievement is a process of collecting the student's information in physics learning process by calculating of physics learning achievement, then the data of the physics learning calculation will be concluded using a criteria to make diccision about physics learning achievement of students. The result of the assessment of physics learning will be shown in qualitative characteristic, and will be used to distinguish the students' ability into three levels, namely: high, medium, or low.

Learning achievement is a paterns activity, assessments, understandings, actions, apreciations, abilities, and skills (Oemar, 2004: 31). In other word, learning achievement is an ability that can be owned by the students after the study (Jihad & Haris, 2008:15). Based on those statement can be concluded that learning achievement is student's skill after study process

in kinds of patterns activity, values, understandings, actions, apresiasion, abilities, and skills.

Assessment instrument is needed to measure physics learning achievement student's. One of technique to assess the student's physics learning achievement is objective test. Objective test items include: true-false, matching, multiple choise, and short answer.

There are two types of multiple choise test, conventional multiple choise test and reasoned multiple choise test. The reasoned multiple choise was developed by Edi Istiyono (Istiyono, Mardapi, & Suparno (2014:5). The reasoned multiple chiose test has characterictic which is scored for completing several steps in the solution process. The score of reasoned multiple choise are polytomous data with four categories, i.e. category 1, 2, 3, and 4. So, reasoned multiple choise scored with partial credit model (PCM).

Partial credit model (PCM) was developed for analyzing test items that require multiple steps as physics problems or math problems where partially correct answers possible (Embretson & Reise, 2000:105). The student must complete four steps in order to student's response in the highest category.

The result of observation indicate that assessment instrument to measure physics learning still formed paper and pencil test. So, variation, inovation, and creation are needed to develop an assessment instrument. The assessment instrument can be made more fun. Games in learning can make situation more fun, relax, however the situation of learning still condusif (John, 1988:110). The advantages of games in learning are making student get the benefit of cognitif and creative.

Based on the above discription, assessment instrument based on board game can be used as alternative assessment to measure physics learning achievement with reasoned multiple chiose. So that, It is needed to develop of assessment instrument based on board games (PhysIBoGa). Based on the desription in the future, the goal is: (1) to develop assessment instrument based on board games and (2) to obtain the characteristic of the PhysIBoGa.

RESEARCH METHOD

This research is the development research with quantitative approach. This instrument development research was done with the modified of the Wilson Model and Antonio Oriundo Model.

The stages of the development of the test are: (1) the design of the test, there are the determination of objective test, the determination of competency to be tested, the determination of the tested material, the preparation of test blue print, the writting of the items, the preparation the scoring guidlines, test validation, and repairing the items and assembling the test; (2) the test tryout, there are the establishment of try out subjects, the implementation of the try out and analyzing of try out data, and test assemeling.

The subject that used in this research is senior high school student's X grade in DIY. The instrument was tried out on 401 students of : SMAN 5 Yogyakarta, SMAN 7 Yogyakarta, SMAN 1 Minggir, SMAN 1 Wates, SMAN 2 Wates, SMAN 1 Pengasih, SMAN 1 Lendah, and SMAN 2 Playen. Selection of school as research subject was based on National Examination ranking in 2014.

The polytomous data with four categories was analyzed using IRT according to Partial Credit Model (PCM) using Quest program. Analyzing question item was done to know the goodness of fit items using PCM, estimation of item difficulties index, and test reliability.

RESULT AND DISCUSSION

Result of The Test Developed

1. Design of The Test

The test design phase included: the determination of test, the determination of competency to be tested, the determination of the tested material, the preparation of test blue print, the writing of the test, the preparation the scoring guidelines, test validation, the repairing the items and assembling the test. The purpose of the test is to measure physics learning achievement of senior high school students. The competency of the test are based on competency 3.3 of 2013 curricula on grade X of senior high school. Base on competency 3.3 of 2013 curricula is analyzing physics quantities on straight line motion with constant velocity and straight line motion with constant acceleration. Material of the test is the motion along a straight line. Test blue print was made as guidelines of writing test. The instrument consisted of 60 items.

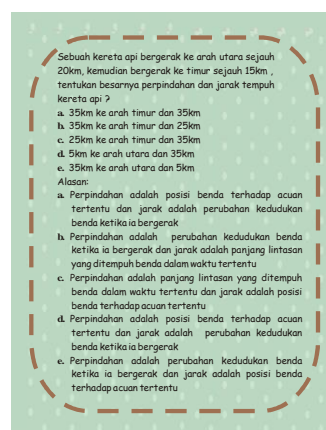
This research uses board game media. So that on design step, board game was design modified monopoly game and snake-ledder game. The modified monopoly game and snake-ledder game were used as assessment instrument based on board game. Design of monopoly board and snake-ledder board presented by Figure 1a and 1b.

a. Question Card

Question items was moved to question card design. Question card was design using Corel Draw X4.



(a)



(b)

Figure 1. a. Design of Monopoly Question Card
b. Design of Snake-ledder Question Card

b. Design of Board Games snake-ledder

The design of monopoly board and snake-ledder board was made with Corel Draw X4. The design of monopoly board and snake-ledder board was presented in Figure 2.



Figure 2. a. Design of Monopoly Board
b. Design of Snake-ladder Board

c. The Equipment of Games

The equipment of monopoly game consists of a dice, tokens, pions, chance card. The equipment of snake-ladder game consists of a dice and tokens. Content validation of the instrument was carried out by experts judgement. The instrument was validated by measurement experts, physics education experts, and practitioners.

2. The Test Try Out

Goodness of fit and Reliability

Empiric data was obtained by the result of test goodness of fit analysis presented in Table 1. All of the items consisting 60 items and PhysIBoGa are fit according to PCM. Reliability of PhysIBoGame is 0.97. Therefore, PhysIBoGame is fit according to PCM (valid) and reliable

Table 1. Test Statistic Fit Parameter

No.	Test Parameter	Item estimation of monopoly game	Item estimation of snake-ladder game
1	Infit MNSQ	1.00 ± 0.02	1.00 ± 0.12

The difficulty index

The item's difficulty index were from -0.06 to 0.07. So that based on difficulty, all of 60 items were good. For more detail, please see diagram distribution of items according to difficulties index subaspect of the instrument in Figure 3. Based on Figure 3, the order of item difficulty index of each aspect form lowest to highest is remember, understand, and apply.

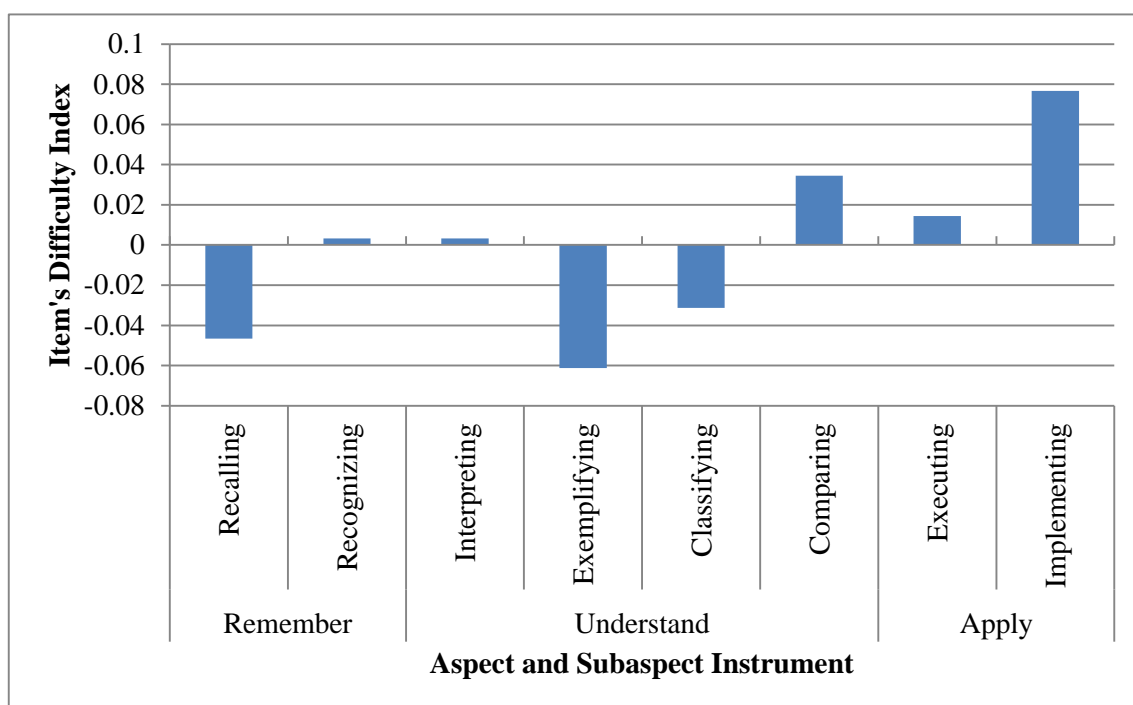


Figure 3. Item's Difficulty Index of Each Aspect and Subaspect Instrument

3. Test Assembling

The instrument was assembled become assessment instrument based on board games. The instrument is called PhysIBoGame.

DISCUSSION

PhysIBoGame's reliability estimation is 0,79 that means the test is qualified as good instrument.. Content validity of the test has been proved by expert judgement. Empirically verified the validity of goodness of fit of partial credit model (PCM). Based on the Table 1, items estimation of monopoly game has the average value and the standard deviation Infit MNSQ 1.00 (about 1) and 0.02 (about 0), then the fit test with 1 PL PCM. Item estimation of snake-ledder game has the average value and the standard deviation Infit MNSQ 1.00 (about 1) and 0.12 (about 0), then the fit test with 1 PL PCM. This is means that PhysIBoGame empirically valid. This is supported by Infit MNSQ of all the items from 0.97 to 1.03, between 0.77 and 1.33, means that all of items that consist 60 items are fit according to PCM. This is caused by several things, among others: (1) the items were developed according to procedure correct item development instruments, (2) the content validity test which consist of 60 items has been proven by expert judgement.

According to Hambleton & Swaminathan (1985:36), the item's difficulty index are good if they varied between 2.00 to 2.00. Based on Figure 3 item's difficulty index the instruments are good.

CONCLUSION AND SUGESSTION

Conclusion

Based on the analysis, the conclusions are as follows:

1. PhysIBoGame instrument was developed on senior high school student's to measure physics learning achievement on physics matter motion along a straight line.
2. Characteristic of PhysIBoGame are:
 - a. The PhysIBoGame consists of 60 items.
 - b. PhysIBoGame has content validity provided by experts judgment and empirical evidence has been getting fit with Partial Credit Model (PCM) based on polytomous data four categories.
 - c. PhysIBoGame is qualified instrument based on reliability estimation.

Sugesstion

Based on the analysis, it is recommended that teachers of senior high school can implement an assessment instrument based on board games.

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